

Rehabilitation following COVID-19 in the pulmonary rehabilitation setting

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The information is not a substitute for healthcare providers' professional judgement.

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Introduction and background

This document provides a guide for pulmonary rehabilitation programs in delivering rehabilitation within existing programs (outpatient or community settings) for people recovering from COVID-19 who have persistent impairments that would respond to pulmonary rehabilitation.

Peer-reviewed literature about how best to provide rehabilitation for this group is still emerging.^{1,2} As more people survive and recover from the virus, additional impairments and responses to pulmonary rehabilitation may be identified.

On 11 March 2020, the World Health Organization declared the COVID-19 (novel coronavirus SARS-CoV-2) outbreak a pandemic. In Australia, there was an initial sharp rise in the numbers of people diagnosed with COVID-19. However, with early border control, rigorous and readily available testing and contact tracing, social distancing and isolation measures, the virus has not reached the prevalence rate that was initially expected in New South Wales (NSW). While Australia and NSW have relatively few cases compared with other countries, we have the opportunity to learn from other countries about the management of the condition in both the acute and recovery phases.

To date, little has been written about the role of pulmonary rehabilitation in the recovery of people with COVID-19 in the Australian healthcare context. However, as COVID-19 is primarily a pulmonary disease, if people have persistent symptoms and impairments following an acute phase of the disease, pulmonary rehabilitation programs may be an appropriate setting for rehabilitation.¹

In May 2020, the NSW Agency for Clinical Innovation's Respiratory Network Pulmonary Rehabilitation Clinical Expert Reference Group (PuReCERG) began to develop this guidance document to assist pulmonary rehabilitation clinicians across NSW when they have received referrals for pulmonary rehabilitation for patients recovering from COVID-19.

A rapid review of the available evidence was undertaken by the [NSW Critical Intelligence Unit](#) and an evidence review produced. Additional peer-reviewed papers that have been published as emerging evidence since this evidence check were also taken into consideration. Criteria for assessing these included credibility of authors, inclusion of papers in high impact journals, availability of any systematic reviews, and validation of any suggested tools within the [Australian Pulmonary Rehabilitation Guidelines](#) and [Pulmonary Rehabilitation Toolkit](#).

Synthesis of any emerging additional evidence was undertaken collaboratively by the PuReCERG, who used their academic and clinical expertise to achieve clinical consensus for literature and tools that would be used to support the development of this guide. Any relevant NSW Health guidance on the treatment and management of COVID-19 was also used to complement the guidance provided within this document. The document was then peer reviewed by experts in pulmonary rehabilitation and the 'treatable traits approach' described below.

This document was prepared using a 'treatable traits approach', which allows for the recognition of clinically important, identifiable and treatable disease characteristics, followed by targeted and individualised treatment interventions to address each trait.³

Such an approach aims to assist pulmonary rehabilitation clinicians to identify, assess and provide appropriate individually designed pulmonary rehabilitation programs for people recovering from COVID-19. While the document focuses on rehabilitation that can be provided within a pulmonary rehabilitation program, there may be the need to refer people recovering from COVID-19 to other specialised rehabilitation programs, such as cardiac, neurological or general rehabilitation programs.

Disease severity and progression

Experiences from Europe and China have found the severity of COVID-19 can vary greatly between people. Approximately 80% of people have been reported to have mild disease, 14% have severe disease and the remaining 6% have been reported to have critical illness.⁴⁻⁶

Of people with COVID-19 who have been hospitalised, 20–25% of cases in Europe and 26–32% in China required admission to an intensive care unit (ICU) for a prolonged period, with a median ICU stay of 10 to 13 days.⁴⁻⁶ People with severe COVID-19 require supportive management for possible complications from viral pneumonia, which may develop into acute respiratory distress syndrome (ARDS), acute hypoxaemic respiratory failure, septic shock and multi-organ failure.⁴⁻⁶

Medical management also includes stabilising complications, such as thromboembolism, gastrointestinal bleeding and critical illness polyneuropathy/myopathy.^{4,6} Chest x-ray and computerised tomography (CT) scans have shown lung infiltrates; and in the longer term, lung fibrosis may occur in some people. Currently, caution needs to be observed for lung function testing due to infection risk (please refer to the ACI [Lung function testing: COVID-19 advice](#) for further information), so the long-term effects of COVID-19 on loss of lung volumes and diffusion capacity are currently unknown.

The effect of COVID-19 will vary greatly over the course of the disease, with most people experiencing some of the following symptoms: fever, cough, fatigue, anorexia, shortness of breath, sputum production, myalgia, central nervous system manifestations (such as headaches, migraines, dizziness and ataxia), and peripheral nervous system manifestations (such as nerve pain, speech, vision and taste problems).^{1,4-6} While some of these symptoms may resolve naturally, some people may have impairments that persist; particularly following a prolonged hospital and ICU stay.

In the recovery period, people with COVID-19 may be expected to present with significant muscle wasting in both the locomotor and respiratory muscles. This may contribute to ongoing breathlessness and fatigue, reduced exercise capacity, poor balance and loss of functional independence.^{7,8}

Rehabilitation in the acute phase during hospital admission

Early rehabilitation intervention is paramount to improving patient outcomes. During the acute phase of COVID-19, early rehabilitation in the form of a multidisciplinary in-reach program is recommended to commence rehabilitation from the time of ICU or ward admission. This multidisciplinary inpatient rehabilitation can help manage extra-pulmonary manifestations.

Early rehabilitation in the form of active mobilisation has been recommended; however, patients need to be medically stable before commencement of gentle exercise training, and rehabilitation staff need to be appropriately skilled.^{5,7,10,11}

When a person is hospitalised with COVID-19, there is a risk of the spread of the virus to others and care must be taken to protect staff and other patients. All interventions and activities must be performed to avoid or reduce the risk of droplet production and aerosol generation.⁷ Please refer to the ACI [Respiratory physiotherapy COVID-19 advice](#) for further information.

Each local health district will have a different protocol for the treatment of inpatients with severe COVID-19. Some will advise that there should be minimal allied health contact with ICU patients, unless absolutely necessary. Statements have recently been published providing guidance on the physiotherapy management and occupational therapy management of people with COVID-19 in the acute setting.^{2,11}

Rehabilitation in the recovery phase following hospital discharge

Each person with COVID-19 will follow a different recovery journey. Some will require an intensive rehabilitation program to fully recover following a hospital and ICU stay, while others with mild disease require no rehabilitation at all. It is unclear if all people who have had COVID-19 (hospitalised or not) will have physical and/or psychological impairments and how they will respond to treatment.^{1,5} There may be a period of natural recovery, especially in relation to fatigue.

Although there have been a number of guidelines published regarding rehabilitation,^{1,9,12} to date there has been only one study that reported outcomes following a rehabilitation program in people recovering from COVID-19. This study from China was a low-quality randomised controlled trial in elderly people recovering from COVID-19. It consisted of a six-week program of inspiratory muscle training and breathing exercises, compared with no rehabilitation. The components of the rehabilitation program reported in the study were not the typical components of a comprehensive pulmonary rehabilitation program. Despite no exercise training, the study did report significant between-group improvement in lung function, six-minute walk distance and quality of life (SF-36) scores favouring the intervention group.¹³

Two recently published documents from the Chartered Society of Physiotherapists (UK)¹² and the British Thoracic Society¹ have recommended that rehabilitation programs need to be:

- flexible and well planned
- based on a thorough initial assessment with the identification of impairments
- followed by a seamless referral process to the most appropriate rehabilitation program.

Consequently, rehabilitation programs will need to be individualised and consider a person's age, pre-existing medical conditions, length of hospital stay and progress following hospital discharge.^{1,12}

For people with COVID-19 presenting for pulmonary rehabilitation, it is important to consider that with reduced gas transfer, exercise desaturation may occur. Therefore, monitoring of oxygen saturation and use of supplemental oxygen may be necessary during rehabilitation. For people recovering from COVID-19 who have a pre-existing respiratory condition, the added burden of a severe pneumonia, hypoxaemia, immobilisation, deconditioning and prolonged pulmonary recovery leave the person much less able to resume activities of daily living (ADLs) and in need of pulmonary rehabilitation.

While people who have had long hospital stays may be the most likely to have ongoing rehabilitation needs, some people who have experienced COVID-19 and have been managed in primary care may still experience persisting symptoms and impairments, and pulmonary rehabilitation may be indicated.⁹

Rehabilitation options following hospital discharge

1. Pulmonary rehabilitation setting

The outpatient pulmonary rehabilitation setting has been suggested as an appropriate site for the rehabilitation of people recovering from COVID-19, especially for those following a long hospital and ICU stay.^{5,7,14} Pulmonary rehabilitation has been shown to result in significant improvements in exercise capacity and quality of life following other acute viral illnesses resulting in ARDS (i.e. influenza A (H1N1) pneumonitis).⁵

Pulmonary rehabilitation programs have the advantage of being staffed with experienced rehabilitation health professionals who are skilled in performing a thorough subjective and objective assessment. They are also familiar with the pulmonary and extra-pulmonary treatable traits that people recovering from COVID-19 may experience.

The symptoms and impacts that people with chronic respiratory disease experience (such as breathlessness; fatigue; oxygen desaturation during activity; sputum retention; reduced quality of life; and mental health issues, such as anxiety, depression and post-traumatic stress disorder) have also been reported in people recovering from COVID-19.^{15,16} People with these symptoms and impacts are regularly managed in current pulmonary rehabilitation programs. In addition, pulmonary rehabilitation programs are structured to provide a personalised approach to care, based on the identification of treatable traits.^{5,17,18}

The focus of rehabilitation should be to:

- reverse the decline from deconditioning
- increase strength
- reduce fatigue
- improve balance
- return to functional independence.

Special considerations in the rehabilitation of people recovering from COVID-19 are presented in Table 1 on page 7.

The treatable traits identified in people recovering from COVID-19 that are amenable to rehabilitation in the pulmonary rehabilitation setting are presented in Table 2 on page 11.

Given the constraints with running face-to-face pulmonary rehabilitation in the outpatient setting due to the pandemic and infection risk, telehealth (via videoconferencing and/or telephone), real-time telerehabilitation¹⁹ and home-based rehabilitation²⁰ are alternative modes for providing rehabilitation that should be considered (refer to the [ACI Guide for delivering pulmonary rehabilitation via telehealth during COVID-19](#) for further information).

2. Cardiac, neurological, and general rehabilitation setting

A number of treatable traits in people recovering from COVID-19 may not be amenable to rehabilitation in the pulmonary rehabilitation setting (refer to Table 3). For example, people recovering from COVID-19 with complex cardiac complications may be more suited to a cardiac rehabilitation program where supervised exercise training and the management of medication and cardiac symptoms can be provided. Other people may have neuromuscular impairments requiring neurological or general rehabilitation.

Table 1. Special considerations when providing rehabilitation within the pulmonary rehabilitation setting for people recovering from COVID-19

| Important clinical points in providing rehabilitation in the outpatient/community setting | |
|---|--|
| Referral pathway | <ul style="list-style-type: none"> • Referral pathways from primary care and hospitals to rehabilitation should be developed to facilitate early identification of people who require rehabilitation, especially those in the community and following ICU or long hospital stay. • Triage referral to the most appropriate rehabilitation program (pulmonary, cardiac, neurological or general rehabilitation) based on thorough initial assessment and identification of treatable traits. |
| Infection control | <ul style="list-style-type: none"> • It is important to note that the period of contagion for COVID-19 remains unclear. However, people who are within a 28-day interval from the time of onset of COVID-19 should have two negative swabs before they attend face-to-face rehabilitation. If a person is still COVID-19 positive, face-to-face rehabilitation in an outpatient setting would not be appropriate. If face-to-face rehabilitation with a person who is COVID-19 positive is required, personal protective equipment (PPE) must be used. • In the outpatient/community setting it is vital to minimise the risk of exposure of patients and staff to COVID-19; therefore, the following safety requirements should be used: <ul style="list-style-type: none"> – Complete a COVID-19 screening questionnaire before and at each visit. – Maintain physical distancing (1.5m). – Provide adequate space per person (4m²). – Avoid interventions which may generate droplets and aerosols. For further information please refer to the following ACI resources: <ul style="list-style-type: none"> • Respiratory physiotherapy COVID-19 advice • Lung function testing COVID-19 advice • Aerosol generating respiratory therapies: High flow nasal prong oxygen • Aerosol generating respiratory therapies: Non-invasive ventilation • Aerosol generating respiratory therapies: Nebulisers – Adhere to respiratory hygiene procedures and use of cough etiquette (refer to Table 2). – Use disposable materials and devices where possible. – Allow for adequate cleaning of surfaces and equipment between uses. – Perform regular hand hygiene. • Please refer to the Checklist for re-opening of pulmonary rehabilitation services. |
| Environment for rehabilitation | <ul style="list-style-type: none"> • Hospital ward: rehabilitation may have begun in the ward by the acute care team prior to discharge. • Home-based: home visits (with appropriate PPE) to enable assessment and a home exercise program to be established. • Telehealth: assessment and rehabilitation (exercise and education) may be delivered via telerehabilitation (videoconference platform). • Outpatient or community rehabilitation: can be offered face-to-face when people are no longer infectious (after two negative swabs). |

Table 1. Special considerations when providing rehabilitation within the pulmonary rehabilitation setting for people recovering from COVID-19 (cont.)

| Important clinical points in providing rehabilitation in the outpatient/community setting | |
|--|--|
| Initial assessment | <ul style="list-style-type: none"> • A comprehensive rehabilitation assessment during recovery from COVID-19 should include: <ul style="list-style-type: none"> – medical history – assessment of symptoms, such as breathlessness, fatigue, sputum, exercise capacity (including assessment of exercise-induced desaturation) – functional limitations – health-related quality of life – mental health issues (e.g. anxiety, depression, post-traumatic stress disorder) – self-efficacy – self-management skills. • A new telephone screening tool, the COVID-19 Yorkshire Rehabilitation Screening (C19-YRS) tool, has been developed to assess and capture symptoms and guide rehabilitation interventions for survivors of COVID-19.²² This tool can be found in Appendix 1. • A new (unvalidated) tool which may be useful to track functional status over time is an ordinal tool that measures the full spectrum of functional outcomes following COVID-19 (the Post-COVID-19 Functional Status (PCFS) Scale).²³ This tool can be found in Appendix 2. • Following assessment and identification of treatable traits that are amenable to rehabilitation in the pulmonary rehabilitation setting, rehabilitation should commence. |
| Exercise prescription | <p>Exercise prescription should start slowly to monitor symptom responses to exercise. Prescription of exercise training should be based on impairments and include frequency, intensity, duration and mode; and be progressed over time.²⁴</p> <p>Safety tips:²⁵</p> <ul style="list-style-type: none"> • For people recovering from COVID-19 who experience fatigue and breathlessness, prescribe intermittent exercise and/or seated aerobic training with back support (e.g. foot pedals, recumbent bike, chair aerobics). • Provide supplementary oxygen during exercise if indicated. (Please refer to the 'Oxygen desaturation' section of Table 2). <p>Considerations for exclusion from exercise training:</p> <ul style="list-style-type: none"> • Resting HR >100 bpm • BP <90/60 mmHg or >140/90 mmHg • Oxygen desaturation of ≥3% during exercise or activity • Other chronic conditions that affect the ability to exercise • Temperature fluctuation (>37.2°C) <p>Exercise termination criteria: follow the usual criteria for exercise termination for all patients.²⁴ These can be found in the Pulmonary Rehabilitation Toolkit. In addition, an extra precaution is oxygen desaturation of ≥3% during exercise.</p> |

Table 1. Special considerations when providing rehabilitation within the pulmonary rehabilitation setting for people recovering from COVID-19 (cont.)

| Important clinical points in providing rehabilitation in the outpatient/community setting | |
|---|---|
| Clinical observation and monitoring during exercise training | <ul style="list-style-type: none"> • Before, during and following exercise, it is important the person recovering from COVID-19 is monitored closely. Observe any change in the person's symptoms and request medical review if there is concern regarding a decline in clinical status. Also record any change in medications, including supplemental oxygen use. • The table below provides some options for monitoring signs and symptoms during exercise assessment and exercise training for face-to-face sessions and via telehealth. The clinician will require advanced skills of clinical observation and history taking if a telehealth model of care is used. If possible, ascertain all objective measure responses (e.g. SpO₂, HR and BP) to exercise from the acute hospital care team prior to discharge. (See table below.) |
| Oxygen therapy | <ul style="list-style-type: none"> • Oxygen therapy may have been prescribed on discharge. Directions on flow rate and hours per day for oxygen use should have been provided by the hospital or prescribing physician. The oxygen requirements will need to be reviewed about once a month after discharge to determine whether ongoing oxygen is necessary. • If long-term oxygen therapy is prescribed (in the presence of pre-existing respiratory disease), all exercise testing and exercise training should be performed on oxygen. • For people in the early phase of recovery from COVID-19, rapid oxygen desaturation during activity has been reported.²⁵ This may be due to lung damage that is slow to resolve, reduced diffusion capacity or possible pulmonary emboli. • Information about monitoring oxygen during exercise can be found in Table 2. |

Monitoring prior to, and during, exercise tests and training

| Signs and symptoms | Face-to-face | Videoconference | Telephone |
|---|---|---|--|
| Respiratory rate (RR) | Observe or place hand on chest | Observe | N/A |
| Heart rate (HR) | Pulse oximeter or palpate pulse | Teach person how to feel own pulse on wrist or neck, or use pulse oximeter if available at home | N/A, unless have a pulse oximeter at home |
| Oxygen saturation via pulse oximetry (SpO₂) | Pulse oximeter | N/A, unless have a pulse oximeter at home | N/A, unless have a pulse oximeter at home |
| Blood pressure (BP) | Electronic or manual sphygmomanometer | N/A, unless have an electronic sphygmomanometer at home | N/A, unless have an electronic sphygmomanometer at home |
| Dyspnoea | Modified 0-10 Borg dyspnoea scale | Modified 0-10 Borg dyspnoea scale | Modified 0-10 Borg dyspnoea scale (provide copy via email or mail) |
| Rate of perceived exertion (RPE) | Modified 0-10 Borg RPE scale | Modified 0-10 Borg RPE scale | Modified 0-10 Borg RPE scale (provide copy via email or mail) |
| Colour | Monitor signs of change in colour – pallor, lips, fingers | May be possible to monitor signs of change in colour – pallor, lips, fingers, but will depend on quality of video | N/A |

Table 1. Special considerations when providing rehabilitation within the pulmonary rehabilitation setting for people recovering from COVID-19 (cont.)

| Important clinical points in providing rehabilitation in the outpatient/community setting | |
|--|---|
| Infection control during airway clearance techniques | <ul style="list-style-type: none"> • Independent airway clearance techniques should be encouraged, where possible, rather than interventions provided by a physiotherapist. • People with COVID-19 should perform sputum/airway clearance alone in a room with the door closed and window open, if possible, followed by thorough cleaning (please refer to Respiratory physiotherapy COVID-19 advice). Soiled tissues containing sputum should be placed in a sealed bag and disposed of safely (if at home) or in a yellow contaminated bin (if in the hospital outpatient environment). The aim is to minimise exposure to other people (health professionals, other patients and family) as much as possible. • If an outpatient service is provided with physiotherapist-delivered airway clearance interventions, services should follow the Clinical Excellence Commission (CEC) guidance on infection prevention and control²⁶ (refer to Management of COVID-19 in healthcare settings), and adhere to local health district regulations. • If a physiotherapist is delivering a rehabilitation program with airway clearance interventions in the home of a person with COVID-19, follow the CEC guidance on infection prevention and control²⁷ (refer to COVID-19 infection prevention and control in primary, community and outpatient settings), and adhere to local health district regulations. |
| Education | <p>The initial assessment of the person recovering from COVID-19 may have identified a number of health issues and needs. In order to help resolve these issues, it is important to refer the person to the appropriate allied health professionals for education and support. For example:</p> <ul style="list-style-type: none"> • occupational therapist for assistance with activities of daily living, returning to work/driving, use of energy-conservation devices • speech pathologist for swallowing deficits and speech impairment • neuropsychologist for cognitive impairment issues • dietician for nutritional support • psychologist for stress management, coping skills, post-traumatic stress disorder, new anxiety and depression • social worker for financial strain or care needs. |
| Use motivational techniques and health coaching principles | <ul style="list-style-type: none"> • As part of the initial assessment, ask the person recovering from COVID-19 about their main health problem at the moment ('What is worrying you the most?'). It may be symptom-based (e.g. shortness of breath or fatigue) or it may be fear-based (e.g. fear of getting COVID-19 again). Rehabilitation management should focus on the person's main problems. • Develop SMART (specific, measurable, achievable, realistic and timed) goals (short-term and long-term) with the person recovering from COVID-19. Revisit the goals regularly to help them stay on track. |
| Re-assessment | <ul style="list-style-type: none"> • The final assessment will include measurement of the same outcome measures used during the initial assessment. It is also important to re-evaluate the program from a patient perspective. An example of a patient satisfaction survey which could be modified for people with COVID-19 can be found in the Pulmonary Rehabilitation Toolkit.²⁴ |

Table 2. Proposed 'treatable traits' amenable to pulmonary rehabilitation

| Treatable trait | Examples of objective measurement tools | Examples of interventions |
|---------------------------|---|---|
| General fatigue | <ul style="list-style-type: none"> • Fatigue Severity Scale (FSS) • FACIT-F • PROMIS-29 (fatigue questions 13-16) • Brief Fatigue Inventory (BFI) | <p>Exercise training should be modified if the person is experiencing high levels of fatigue.</p> <p>If reporting high levels of fatigue during ADLs, the patient may require referral to occupational therapy for:</p> <ul style="list-style-type: none"> • home modification and assistive equipment • behavioural modification education and advice (re: balancing activity and rest) |
| Exertional fatigue | Modified 0-10 Borg Rate of Perceived Exertion (RPE) scale | <p>Exercise training should cease if the person is experiencing fatigue that is not relieved with rest.</p> <p>If RPE score during exercise training is high (i.e. >5):</p> <ul style="list-style-type: none"> • try intermittent exercise training rather than continuous exercise • keep sessions shorter in duration • teach energy conservation techniques • teach pacing • increase activity gradually (activity tolerance may be very low and require intervals of activity and rest). |
| Breathlessness | <ul style="list-style-type: none"> • Modified 0-10 Borg Dyspnoea Scale • Modified Medical Research Council Dyspnoea Scale (mMRC) | <p>Education and techniques to manage breathlessness may include:</p> <ul style="list-style-type: none"> • management of fear and panic (may require referral to clinical psychology) • breathing control • pursed lip breathing • paced breathing (e.g. functional movements timed with breathing) • positions to relieve breathlessness (e.g. forward lean posture with upper limb support. If breathless during supine lying, elevate bed head) • hand-held fan directed over the mouth and lower face (NOT recommended in people who are still infectious because of the risk of spreading infection by droplets). An alternative is facial cooling using a wet wipe (disposed of after each use)²⁸ • pharmacological management for distressing breathlessness at rest (e.g. opioids, anxiolytic sedatives)²⁹ <p>Note: The primary role of supplementary oxygen is to correct hypoxaemia; it may help breathlessness in severe hypoxaemia but not when hypoxaemia is mild or absent.²⁹</p> <p>Refer to the Pulmonary Rehabilitation Toolkit²⁴ for more information.</p> |

Table 2. Proposed ‘treatable traits’ amenable to pulmonary rehabilitation (cont.)

| Treatable trait | Examples of objective measurement tools | Examples of interventions |
|--|---|---|
| Oxygen desaturation during exercise | Pulse oximetry | <p>In people recovering from COVID-19 who do not have a pre-existing respiratory condition, oxygen desaturation $\geq 3\%$ should be considered significant desaturation.²⁸</p> <ul style="list-style-type: none"> • The use of supplemental oxygen during exercise assessment and exercise training may be necessary if desaturation occurs. • Use oxygen during exercise if the person has been prescribed long-term oxygen therapy. <p>Monitoring of oxygen saturation during exercise:</p> <ul style="list-style-type: none"> • Telehealth: If an oxygen saturation monitor is available, monitor saturation levels before, during and after exercise tests; and before and after exercise training. If pulse oximetry is not available, use caution and advanced skills of clinical observation. • Face-to-face: Monitor oxygen saturation levels throughout exercise testing (e.g. six-minute walk test (6MWT), sit-to-stand tests); and before and after exercise training. |
| Decreased exercise capacity | <ul style="list-style-type: none"> • 6MWT • Cardiopulmonary exercise testing (CPET) • 30 second sit-to-stand (STS) test • 1-minute STS test • 2-minute walk test • 40 step test (not validated) | <ul style="list-style-type: none"> • Prescribe an aerobic exercise training program based on assessment of exercise capacity (i.e. 6MWT). Refer to the Pulmonary Rehabilitation Toolkit for further information. • Exercise prescription should be guided by general pulmonary rehabilitation exercise prescription principles. The aim is to restore the person (as close as possible) to their previous level of activity. • Be guided by symptoms of shortness of breath and fatigue, and signs of oxygen desaturation.²⁴ (Refer to the Pulmonary Rehabilitation Toolkit for further information). <p>Aerobic exercise training²⁵</p> <ul style="list-style-type: none"> • Frequency: 3–5 sessions per week; commence with every second day (with rest day in between). • Intensity: moderate intensity, 3–4 on modified 0–10 Borg dyspnoea scale (note: high intensity interval training (HIIT) is NOT recommended as this may increase the likelihood of droplet expulsion). For those recovering from severe/critical illness, people who are elderly, people who are obese, and people with complex comorbidities and other complications,³¹ initially prescribe a gentle exercise program of low intensity physical activity/exercises. Aim for an intensity of < 3 METS or ≤ 3 on the modified 0–10 Borg dyspnoea and/or RPE scale.³² • Duration: start at a low interval (e.g. 2 minutes exercise, 2 minutes rest) and build up to 20–30 minutes continuous. • Mode: endurance training (e.g. walking, cycling, stepping, swimming, jogging), depending on pre-morbid activity/exercise routine. • Progression: 5–10% per week; increase duration first, then increase intensity. |

Table 2. Proposed ‘treatable traits’ amenable to pulmonary rehabilitation (cont.)

| Treatable trait | Examples of objective measurement tools | Examples of interventions |
|---|--|---|
| Muscle weakness (respiratory and peripheral muscles) | <p>Functional assessment:</p> <ul style="list-style-type: none"> • 5 sit-to-stand test (5STS) <p>Muscle strength:</p> <ul style="list-style-type: none"> • UK Medical Research Council (MRC) test • Manual muscle test (MMT) • Isokinetic muscle testing (IMT) • Grip strength <p>Respiratory muscle strength:</p> <ul style="list-style-type: none"> • Maximum inspiratory pressure (MIP) (please refer to Respiratory physiotherapy COVID-19 advice). | <ul style="list-style-type: none"> • Prescribe a strength training program.²⁵ Be guided by general strength training principles, bearing in mind symptoms (e.g. shortness of breath, desaturation and fatigue). Start slowly and build up as able. • For further information, please refer to the fatigue section in this Table and the Pulmonary Rehabilitation Toolkit. <p>Strength training²⁵</p> <ul style="list-style-type: none"> • Frequency: 2–3 sessions/week. • Intensity: start with low weights and build up to 3 sets of 10 repetitions that can be completed comfortably; or aim for a dyspnoea or RPE score of 3 to 4 on modified 0–10 scale. • Mode: strength training using available equipment. For those recovering from severe/critical illness, people who are elderly, people who are obese, and people with complex comorbidities and other complications,^{31,31} focus on functional strengthening activities. • Duration: will vary with each person. • Progression: as tolerated. <p>Respiratory muscle training may be indicated if inspiratory pressures are low²⁵</p> <p>Use an inspiratory muscle training device with prescription based on MIP results (if available):</p> <ul style="list-style-type: none"> • Frequency: once a day. • Intensity: three sets with 10 breaths in each set; set training initially at 60% of the individual’s MIP, with a rest period of 1 minute between the sets. • Duration: 10 minutes. |
| Balance | <ul style="list-style-type: none"> • Short Physical Performance Battery (SPPB) • Berg Balance Scale (BBS) • Mini-BESTest • Time Up and Go (TUG) | <ul style="list-style-type: none"> • For people with balance problems, include static and dynamic/functional balance training in the rehabilitation program. • An option is the Otago strength and balance exercise program. |

Table 2. Proposed 'treatable traits' amenable to pulmonary rehabilitation (cont.)

| Treatable trait | Examples of objective measurement tools | Examples of interventions |
|---|---|---|
| Reduced physical activity | <ul style="list-style-type: none"> • Accelerometers, e.g. ActivPAL, ACTi Graph • Pedometers • Personal fitness trackers, e.g. Fitbit, Garmin, Apple Watch • Mobile phones: apps and built-in GPS tracking systems | <ul style="list-style-type: none"> • Pulmonary or general rehabilitation may improve physical activity with associated improvements in exercise capacity; however, some people recovering from COVID-19 may require a behaviour change intervention, such as physical activity health coaching, in order to focus on specific changes to physical activity behaviours. • Health coaching to increase physical activity levels may involve advice and/or counselling on: <ul style="list-style-type: none"> – activities to engage in that are relevant to the individual – activity goals and progression – monitoring activity goals to provide feedback to the individual (e.g. wearable devices). • Models of behaviour change can be useful to guide the health coaching process, such as the 'Behaviour Change Wheel'.³³ |
| Reduced health-related quality of life (HRQoL) | <p>A generic measure of HRQoL:</p> <ul style="list-style-type: none"> • PROMIS-29 • SF-36 • EQ-5D | <p>Holistic rehabilitation should incorporate exercise, education and self-management skills.</p> <p>Other suggested interventions include:</p> <ul style="list-style-type: none"> • encouraging participation in family and social activities • encouraging resumption of hobbies and activities of enjoyment • communication strategies and 'virtual' social support (if still requiring isolation). |
| Sputum | <ul style="list-style-type: none"> • Description of sputum – colour, amount, consistency, ease of expectoration, change from 'normal' | <p>Excess sputum production has not been identified as a common long-term sequelae resulting from COVID-19. If sputum production is a problem, the following treatment techniques may be considered:</p> <ul style="list-style-type: none"> • Assess effectiveness of previous airways clearance techniques • Huff or cough +/- overpressure • Forced expiratory technique (FET) or active cycle of breathing (ACBT) • Postural drainage or upright positioning • Percussion and vibrations • Positive expiratory pressure devices (e.g. TheraPEP, Acapella, Flutter) • Mobilisation • Exercise <p>Refer to Respiratory therapies COVID-19 advice for more information.</p> |

Table 2. Proposed 'treatable traits' amenable to pulmonary rehabilitation (cont.)

| Treatable trait | Examples of objective measurement tools | Examples of interventions |
|--|---|---|
| Psychological disorders | <ul style="list-style-type: none"> Hospital anxiety and depression scale (HADS) Depression, Anxiety and Stress Scale (DASS-21) | <p>Pulmonary rehabilitation can improve anxiety and depression.³⁴ If there are high levels of anxiety or depression, refer to psychology⁹, psychiatry or GP.</p> |
| Poor self-management and self-monitoring skills | <ul style="list-style-type: none"> Patient Activation Measure (PAM) Pulmonary Rehabilitation Adapted Index of Self-Efficacy Tool (PRAISE) | <ul style="list-style-type: none"> Education is key to improving a person's self-management skills⁹ and will depend on their needs. Topics may include medications, symptom monitoring (see Table 1) and skills for coping with an illness. People recovering from COVID-19 may require appropriate referral to allied health professionals to improve self-management skills.³⁵ Self-management education via telehealth may be effective and available. <p>Useful resources:</p> <ul style="list-style-type: none"> Knowledge in COVID-19 Supporting your recovery after COVID-19 Exercise diary: The Better Living with Exercise Book |

Table 3. Treatable traits amenable to cardiac rehabilitation, neurological rehabilitation or general rehabilitation

| Treatable trait | Information | Interventions |
|---------------------------------|--|---|
| Cardiac complications | <p>Cardiac impairments have been reported in people recovering from COVID-19, including atrial fibrillation, arrhythmias, postural hypotension and cardiomyopathy. Cardiogenic shock has also been reported as a late complication of COVID-19.³⁶</p> | <p>Following initial assessment and identification of cardiac impairments, the person recovering from COVID-19 will require referral to cardiac rehabilitation.</p> |
| Neurological impairments | <p>A number of central nervous system manifestations have been reported in survivors of critical COVID-19 and these deficits could play a significant role in overall disability.³⁷ One study reported that 36% of people with severe and non-severe COVID-19 had neurological manifestations.³⁸</p> <p>People with pre-morbid neurological conditions have been reported to deteriorate during the COVID-19 infection.³⁹</p> | <p>If the initial assessment identifies neurological impairments, the person recovering from COVID-19 will require referral to neurological rehabilitation.</p> |

Table 3. Treatable traits amenable to cardiac rehabilitation, neurological rehabilitation or general rehabilitation (cont.)

| Treatable trait | Information | Interventions |
|---------------------------------|--|---|
| Cognitive impairment | <p>Cognitive impairment is listed among the most common complications following COVID-19.⁹</p> <p>Long ICU stay, anoxic damage and viral involvement in those who had severe COVID-19 can lead to memory, attention and executive function deficits, as well as confusion, especially in older people.^{37,39,40}</p> | <p>If the initial assessment identifies cognitive impairment, neuropsychological support may be required and may include referral for formal assessment and/or psychogeriatric assessment. This would be followed by counselling sessions, psychological support and cognitive training.³⁹</p> <p>The Montreal Cognitive Assessment (MoCA) may be a useful test to assess cognitive impairment.</p> |
| Joint stiffness and pain | <p>Joint stiffness and pain have been associated with immobilisation during a long hospital stay, mainly in older people with moderate to severe COVID-19, and in younger adults with critical COVID-19.³⁷</p> | <p>Following initial assessment and identification of joint stiffness and pain, the person recovering from COVID-19 will require referral to a rheumatology/ musculoskeletal service.</p> <p>Recommendations include pain relief as needed, mobilisation and exercise (as tolerated within the limits of pain). If pain becomes a limiting factor to exercise training, then referral to appropriate rehabilitation programs is recommended (e.g. rheumatology, osteoarthritis, pain clinic or general rehabilitation service).</p> |
| Dysphagia and dysarthria | <p>Dysphagia (difficulty swallowing) has been reported in some people with COVID-19 following intubation and an ICU stay.</p> <p>The mechanisms of dysphagia in people with COVID-19 include mechanical causes, diminished awareness of the position or movement of the body, laryngeal injury and peripheral or central nervous system (CNS) damage.³⁷</p> | <p>It is recommended that assessment for dysphagia is performed in people with COVID-19 after extubation.³⁷</p> <p>If difficulties with swallowing and speech are identified, the person should be referred to speech pathology.</p> |
| Nutritional impairments | <p>A long hospital stay, in particular in ICU, may result in poor nutritional status, where nutritional supplementation may have begun.⁴¹</p> <p>Following discharge, it is important that good eating habits and additional nutrients are provided to ensure the person is able to perform exercise and avoid fatigue.</p> | <p>If poor nutritional status is identified, the person recovering from COVID-19 should be referred to a dietician.</p> |

Conclusion

The management of people recovering from COVID-19 needs careful consideration, and rehabilitation needs will vary greatly depending on each person's individual experience.

A comprehensive assessment is required to identify treatable traits, followed by an individualised rehabilitation plan and referral to the most appropriate rehabilitation service for management. The pulmonary rehabilitation setting may be an appropriate setting for COVID-19 survivors who have persistent impairment/s that are amenable to pulmonary rehabilitation. The expertise and skills of pulmonary rehabilitation clinicians makes them well placed to support the recovery of these individuals.

Information in this document is based on what is known at present. New information about the benefits of specific post-COVID-19 interventions may modify this advice, especially as we learn more about the long-term effects of COVID-19.

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Appendix 1: COVID-19 Yorkshire Rehab Screen (C19-YRS)²²

Patient name and number:

Time and date of call:

Staff member making call:

We are getting in touch with people who have been discharged after having had a diagnosis of coronavirus disease (Covid-19). The purpose of this call is to find out if you are experiencing problems related to your recent illness with coronavirus. We will document this in your clinical notes. We will use this information to direct you to services you may need and inform the development of these services in the future.

This call will take around 15 minutes. If there's any topics you don't want to talk about you can stop the conversation at any point. Do you agree to talk to me about this today?

Yes No

Opening questions:

Have you had any further medical problems or needed to go back to hospital since your discharge?

Re-admitted? Yes No

Details:

Have you used any other health services since discharge (e.g. your GP?)

Re-admitted? Yes No

Details:

I'll ask some questions about how you might have been affected since your illness. If there are other ways that you've been affected then there will be a chance to let me know these at the end.

1. Breathlessness

On a scale of 0–10, with 0 being not breathless at all, and 10 being extremely breathless, how breathless are you: (N/A if does not perform this activity)

| | Now | Pre-COVID |
|--------------------------------------|---------------------------------------|---------------------------------------|
| a) At rest? | 0–10: | 0–10: |
| b) On dressing yourself? | 0–10: N/A | 0–10: N/A |
| c) On walking up a flight of stairs? | 0–10: N/A <input type="checkbox"/> | 0–10: N/A <input type="checkbox"/> |

2. Laryngeal/ airway complications

Have you developed any changes in the sensitivity of your throat, such as troublesome cough or noisy breathing?

Yes No

If Yes: rate the significance of impact on a scale of 0-10 (0 being no impact, 10 being significant impact)

0 1 2 3 4 5 6 7 8 9 10

3. Voice

Have you or your family noticed any changes to your voice, such as difficulty being heard, altered quality of the voice, your voice tiring by the end of the day or an inability to alter the pitch of your voice?

Yes No

If Yes: rate the significance of impact on a scale of 0–10 (0 being no impact, 10 being significant impact)

0 1 2 3 4 5 6 7 8 9 10

4. Swallowing

Are you having difficulties eating, drinking or swallowing such as coughing, choking or avoiding any food or drinks?

Yes No

If Yes: rate the significance of impact on a scale of 0–10 (0 being no impact, 10 being significant impact)

0 1 2 3 4 5 6 7 8 9 10

5. Nutrition

Are you or your family concerned that you have ongoing weight loss or any ongoing nutritional concerns as a result of COVID-19? Yes No

Please rank your appetite or interest in eating on a scale of 0–10 since COVID-19 (0 being same as usual/no problems, 10 being very severe problems/reduction)

0 1 2 3 4 5 6 7 8 9 10

6. Mobility

On a 0–10 scale, how severe are any problems you have in walking about? (0 means I have no problems, 10 means I am completely unable to walk about.)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

7. Fatigue

Do you become fatigued more easily compared to before your illness? Yes No

If yes, how severely does this affect your mobility, personal cares, activities or enjoyment of life? (0 being not affecting, 10 being very severely impacting)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

8. Personal care

On a 0–10 scale, how severe are any problems you have in personal care, such as washing and dressing yourself? 0 means I have no problems, 10 means I am completely unable to do my personal care.

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

9. Continence

Since your illness, are you having any new problems with:

- controlling your bowel Yes No
- controlling your bladder Yes No

10. Usual activities

On a 0–10 scale, how severe are any problems you have in your usual activities, such as your household role, leisure activities, work or study?

(0 means I have no problems, 10 means I am completely unable to do my usual activities.)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

11. Pain / discomfort

On a 0–10 scale, how severe is any pain or discomfort you have?

(0 means I have no pain or discomfort, 10 means I have extremely severe pain.)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

12. Usual activities

Since your illness have you had new or worsened difficulty with:

Concentrating? Yes No

Short term memory? Yes No

13. Cognitive: communication

Have you or your family noticed any change in the way you communicate with people, such as making sense of things people say to you, putting thoughts into words, difficulty reading or having a conversation? Yes No

If Yes: rate the significance of impact on a scale of 0-10 (0 being no impact, 10 being significant impact)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

14. Anxiety

On a 0–10 scale, how severe is the anxiety you are experiencing?

(0 means I am not anxious, 10 means I have extreme anxious)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

15. Depression

On a 0–10 scale, how severe is the depression you are experiencing?

(0 means I am not depressed, 10 means I have extreme depression)

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

16. PTSD screen

a) Have you had any unwanted memories of your illness or hospital admission whilst you were awake (not counting dreams)? Yes No

If yes, how much do these memories bother you? (is the distress: mild / moderate / severe / extreme)

b) Have you had any unpleasant dreams about your illness or hospital admission? Yes No

If yes, how much do these dreams bother you? (is the distress: mild / moderate / severe / extreme)

c) Have you tried to avoid thoughts or feelings about your illness or hospital admission? Yes No

If yes, how much effort do you make to avoid these thoughts or feelings? (mild / moderate / severe / extreme)

d) Are you currently having thoughts about harming yourself in any way? Yes No

17. Global perceived health

How good or bad is your health overall? 10 means the best health you can imagine.

0 means the worst health you can imagine.

Now 0 1 2 3 4 5 6 7 8 9 10

Pre-COVID 0 1 2 3 4 5 6 7 8 9 10

18. Vocation

What is your employment situation and has your illness affected your ability to do your usual work?

Occupation:

Employment status before COVID-19 lockdown:

Employment status before you became ill:

Employment status now:

19. Family/carers views

Do you think your family or carer would have anything to add from their perspective?

Closing questions:

Are you experiencing any other new problems since your illness we haven't mentioned?

Any other discussion (clinical notes):

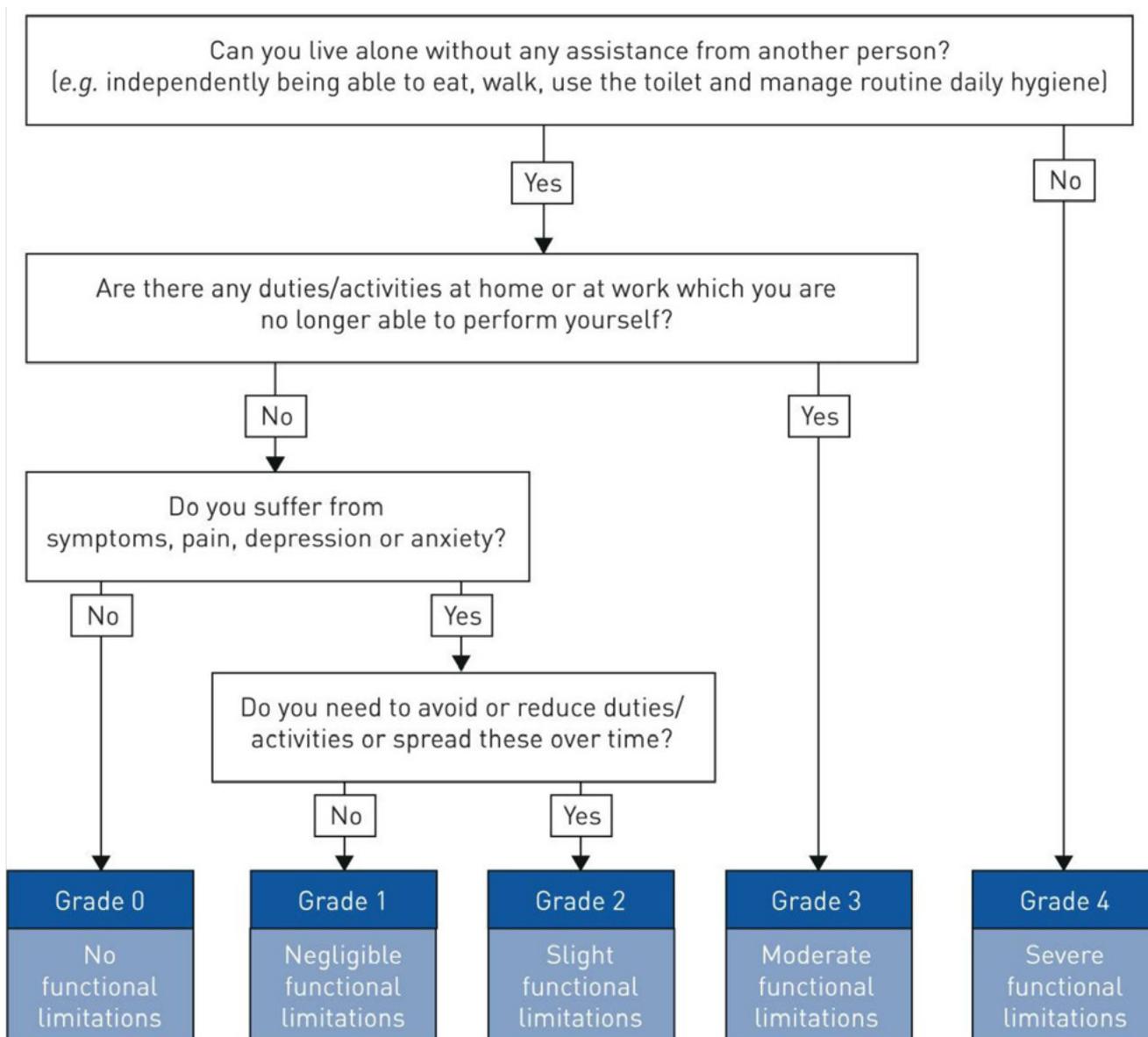
Appendix 2: Post-COVID-19 Functional Status²³

Measure the impact of COVID-19 on your own life: Manual to the Post-COVID-19 Functional Status Scale for patients

To indicate and discuss the impact of COVID-19 on your daily life, you can use the flowchart (Figure 1) and/or the patient questionnaire (Table 4), both belonging to the post-COVID-19 functional status scale (PCFS). This PCFS scale covers the entire range of functional outcomes by focusing on limitations in usual duties/activities, either at home or at work/

study, as well as changes in lifestyle. Sports and social activities are also included in this. Limitations or symptoms may vary over time. The measurement concerns the average situation of the past week (except for when assessed at discharge; in which case, it concerns the situation of the day of discharge).

Figure 1. Flowchart for patient self report of the Post-COVID-19 Functional Status Scale



You can assign yourself to the appropriate PCFS scale grade by following the steps on the flowchart and/or by ticking the right box in the table. In case two, grades seem to be appropriate. Always choose the highest grade with the most limitations.

Together with your treating physician, you can coordinate when and how often you should measure your functional status. The treating physician will compare these results with normal recovery after the infection. In case of slow or incomplete recovery, the physician will indicate whether additional diagnostic tests are necessary, or treatment could be started.

Table 4. Patient questionnaire for patient self-report of the Post COVID-19 Functional Status Scale

| How much are you currently affected in your everyday life by COVID-19? (Please indicate which one of the following statements applies to you most) | Corresponding PCFS scale grade |
|---|--------------------------------|
| I have no limitations in my everyday life and no symptoms, pain, depression or anxiety related to the infection. | 0 |
| I have negligible limitations in my everyday life as I can perform all usual duties/ activities, although I still have persistent symptoms, pain, depression or anxiety. | 1 |
| I suffer from limitations in my everyday life as I occasionally need to avoid or reduce usual duties/activities or need to spread these over time due to symptoms, pain, depression or anxiety. I am, however, able to perform all activities without any assistance. | 2 |
| I suffer from limitations in my everyday life as I am not able to perform all usual duties/ activities due to symptoms, pain, depression or anxiety. I am, however, able to take care of myself without any assistance. | 3 |
| I suffer from severe limitations in my everyday life: I am not able to take care of myself and therefore I am dependent on nursing care and/or assistance from another person due to symptoms, pain, depression or anxiety. | 4 |

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The Agency for Clinical Innovation (ACI) is the lead agency for innovation in clinical care.

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- evidence-based
- value-driven.

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